AMENDMENTS TO THE DRAWINGS

Reference numeral 21 has been changed to reference numeral 22 in FIG. 3C to correspond with the specification. Therefore, please replace the attached drawing sheet containing FIG. 3C for the original drawing sheet containing this figure.

Attachment: Corrected Drawing Sheet including FIG. 3C

REMARKS

By this amendment, claims 1-7 and 10-13 have been amended and claims 8-9 have been cancelled. Currently, claims 1-7 and 10-13 are pending in the application.

Claims 1-13 were rejected under 35 USC 102(b) as being anticipated by Muramatsu (U.S. Patent No. 5,952,806). This patent is applicant's previous patent.

This rejection is respectfully traversed in view of the amendments to the claims and the following remarks.

The present invention relates to a performance information input operation that permits imitating or simulating performance styles that are employed in violin-type instruments without being required to produce noise. The present invention specifically relates to a performance input apparatus provided with an operating section displaceable about one or more axes, and more particularly to a technique of imparting the displaceable operating section with a virtual reactive force responsive to an input operation (an input operating force), by a human operator, of the operating section.

As shown in Fig. 1, a performance input apparatus 1

generally comprises an operating section 2, a base section 3 and a junction section 4 connecting the operating section 2 and the base section 3 so that the junction section 4 allows the operating section 2 to be displaced relative to the base section 3. The operating section 2 is movable or displaceable in three directions depicted by double-headed arrows A, B and C in response to operation by a human operator (see page 6, lines 1-8).

As illustrated in Fig. 3A, an X-axis pivot section 20, which includes a sensor section 30 and a motor section 40, is oriented in such a manner that a pivot axis X′ (rotation axis) of the motor section 40 extends parallel to the axis (pivot axis X) of the main shaft 5 of the operating section 2. On the X-axis motor section 40, there is provided a first gear 50 that is caused to pivot with pivotal or angular movement (i.e., rotation) of the motor section 40. A second gear 51 meshing with a first gear 50 is provided on a pivotal-movement transmission shaft 52 extending substantially perpendicularly to the pivot axis X′, so that the second gear 51 is pivotable about an axis, denoted by "axe", together with the pivotal-movement transmission shaft 52. On the pivotal-movement transmission shaft 52, there is provided a pulley 53 engaging with the main shaft 5 of the operating section

2 and pivotable together with the transmission shaft 52. The second gear 51, the pivotal-movement transmission shaft 52 and the pulley 53 together constitute the above-mentioned displacement transformation mechanism. For example, the transmission shaft 52 or the rotation shaft of the motor section 40 coupled with the first gear 50 interlocked with the transmission shaft 52 constitutes a rotary shaft of the X-axis pivot section 20 (see page 12, lines 5-22).

The X-axis pivot section 20 includes an X-axis sensor section 30 for detecting an operating position of the operating section 2 along the pivot axis X, and the X-axis motor 40 performing pivotal movement about the pivot axis X, as illustrated in Fig. 3A (see page 10, lines 11-14). The sensor section 30 may be in the form of a velocity sensor or an acceleration sensor, rather than position sensors, for detecting an operating velocity or acceleration (see page 11, lines 13-15).

A touch data table stores a multiplicity of pieces of reactive force information for generating reactive forces to be imparted to the operating section 2 for, i.e. in correspondence with, the individual pivot axes in response to outputs (representing, for example, a position, velocity and acceleration) from the X-axis, Y-axis and Z-axis sensor sections

30, 31 and 32. Namely, from the touch data table, three pieces of reactive force information are output at a time which correspond to the outputs from the X-axis, Y-axis and Z-axis sensor sections 30, 31 and 32 (see page 19, lines 2-9).

As the motor section 40 is driven to cause the first gear 50 to pivot, the pivoting force of the first gear 50 is transmitted to the second gear 51. The transmitted pivoting force causes the second gear 51 to pivot about the axis axe. Namely, the pivotal movement about the pivot axis X′ is transformed via the second gear 51 into pivotal movement about the axis axe. As the pivotal-movement transmission shaft 52 is turned about the axis axe in response to the pivotal movement of the second gear 51, the pulley 53 is caused to pivot about the axis axe (see page 12, line 23 - page 13, line 2). The rotating force of the pulley 53 acts on the operating section 2 (i.e., its main shaft 5), so that the operating section 2 is moved or displaced linearly in a direction of the double-headed arrow A′, as illustrated in Fig. 3A, in response to the rotation of the pulley 53 (see page 13, lines 8-11).

An interface 107 is provided for receiving outputs from the X-axis, Y-axis and Z-axis sensor sections 30, 31 and 32 in a time-division multiplexing manner. Each of the sensor outputs

received via the interface 107 is converted by an A/D converter 108 into a digital signal, which is then supplied via the communication bus 106 to the CPU 100 (see page 17, lines 17-21).

Independent claim 1 has been amended to recite "a rotary driver that drives the rotary shaft of said pivot section on the basis of the reactive force information so that said mechanism of said pivot section transforms the rotational movement of said rotary shaft into linear movement along said linear-displacement axis of said operating section to thereby impart a linear reactive force to said operating section".

These features are not shown or suggested by Muramatsu.

Muramatsu relates to an inner force sense controller and, more particularly, to an inner force sense controller for providing variable resistance or variable power assist to a multidirectional moving object (see column 1, lines 9-12).

As shown in FIG. 11, an inner force sense controller largely comprises three-dimensional actuators 30 for driving movable objects 31, sensors 32 for producing three kinds of positional data information X, Y and Z and a controlling unit 33 responsive to the three kinds of positional data information X/Y/Z for controlling the three-dimensional actuators 30 (see column 10, lines 27-34).

Muramatsu discloses that sensor elements 32a/32b/32c detect a current position x of a plunger 30a, a current position y of a plunger 30b and a current position z of a plunger 30c, respectively, and that the sensor 32 supplies the positional signals Sx/Sy/Sz to multiplexers 33a, 33b and 33c, respectively (see column 11, lines 15-20).

Muramatsu also discloses a vector arithmetic processor 33d which respectively calculates current velocities X′, Y′ and Z′ on the basis of the current position (X, Y, Z) and the previous position, and further calculates current accelerations X″, Y″ and Z" on the basis of the current velocities X′/Y′/Z′ and the previous velocities, respectively (see column 11, lines 32-37).

The sensors 22 generate sets of positional signals Sx/Sy/Sz, and the multiplexers 33a/33b/33c successively transfer the sets of positional signals Sx/Sy/Sz to the vector arithmetic processor 33d in a time sharing fashion. The vector arithmetic processor 33d successively determines sets of components Fx/Fy/Fz as described hereinbefore, and supplies the sets of components Fx/Fy/Fz to the demultiplexers 33j of the driving units 33f/33g/33h in a time sharing fashion. Three pwm drivers 33k form sets of pwm drivers, and the demultiplexers 33j distribute the data signals representative of the sets of components

Fx/Fy/Fz to the sets of pwm drivers, respectively, in such a manner that the associated three-dimensional actuators 32 exert the set of components Fx/Fy/Fz on the associated moving objects 31, respectively (see column 11, line 59 - column 12, line 6).

Applicant respectfully submits that Muramatsu does not disclose a rotary driver that drives the rotary shaft of said pivot section on the basis of the reactive force information so that said mechanism of said pivot section transforms the rotational movement of said rotary shaft into linear movement along said linear-displacement axis of said operating section to thereby impart a linear reactive force to said operating section.

Figs. 11 and 12 of Muramatsu show that reactive force is imparted to three-dimensional movement of the single moving object 31 by means of the three-dimensional actuator 30 comprising the solenoid-operated linear actuators 30a, 30b and 30c corresponding to the dimensions x, y and z (see column 11, lines 27-56 and column 13, lines 25-48). Fig. 22 shows that rotational movement, about two axes, of a lever 90a is imparted with reaction movement by means of rotaty actuators 90 corresponding to the axes (column 24, lines 21-45). Fig. 25 shows that the reaction force is imparted to three-dimensional movement of a single knob by means of three solenoid-operated

linear actuators 100a, 100b and 100c (column 24, line 59 - column 25, line 12).

Namely, with the three-dimensional type operator disclosed in Muramatsu, the reactive force is imparted by the linear actuators, as seen in Figs. 11, 12 and 25. This technique is similar to the technique disclosed in Japanese Patent Application Laid-Open Publication No. 10-177387 which is discussed in the Background of the Invention section of the specification of the present application. This technique also presents drawbacks as set forth in the specification, page 2, lines 15-22. Namely, such a arrangement is not suited for impartment of a reactive force corresponding to relatively great displacement, such as that caused by a string-rubbing operation, of a bow-shaped operating device.

In amended claim 1, on the other hand, a rotary driver (rotary motor) is used to impart a linear reactive force to linear movement of the operating section. Thus, the claimed invention can avoid the drawbacks that would be encountered by Muramatsu, and it achieves a superior benefit in that it can generate an appropriate reactive force to a large linear operating displacement, such as string-rubbing operation of a bow-shaped operating device, using an apparatus having a small

overall size.

The conventional two-dimensional operator, shown in Fig. 22 of Muramatsu, merely uses a rotary motor to impart pivotal movement of the operating section with a reactive force in the pivoting direction. Therefore, Muramatsu fails to disclose using a rotary driver (rotary motor) in order to impart a linear reactive force to linear movement of the operating section as recited in amended claim 1.

For these reasons, it is believed that Muramatsu does not show or suggest the claimed features of the present invention.

Claims 2-7 and 10-13 all depend on claim 1, directly or indirectly. Accordingly, applicant respectfully submits that all pending claims 2-7 and 10-13 clearly define over the prior art of record and should be allowed.

Claim 3 has been amended to clarify the arrangements of Figs. 3B and 3C in addition to the arrangement of claim 1. With the arrangements of amended claim 3, a combination of linear displacement operation along one axis (i.e., A or X) and pivotal displacement along two axes (B and C, i.e., Y and Z) can be effected via a single operating section (2, 5), and thus, there can be provided a three-dimensional performance input apparatus suited for simulation of a violin-type performance input

operation, etc.

Therefore, in view of foregoing amendments and remarks, it is respectfully submitted that claims 1-7 and 10-13 are allowable over the prior art of record. Thus, applicant respectfully submits that the application is now in condition for allowance and an action to this effect is respectfully requested.

If there are any questions or concerns regarding the amendments or these remarks, the Examiner is requested to telephone the undersigned at the telephone number listed below.

Respectfully submitted,

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